

Caption list

Figure 1.

Dehydrogenation of n-paraffins : GC×GC chromatograms of the feed (A) and the products at 10% (B) or 20% (C) conversion. Experimental conditions : see Table 1. The repetitive pattern representing the distribution of isoparaffins (I), olefins (O), diolefins (diO), and aromatics (A) in the elution zone of a normal paraffin (nP), with the same carbon atoms (n), is enhanced in the insert in Fig. 1-C. Identification : 1 ; n-nonane ; 2. n-decane ; 3. n-undecane ; 4. n-dodecane ; 5. n-tridecane ; 6. n-tetradecane ; 7 n-pentadecane ; 8. ethylbenzene ; 9. nonene-1 ; 10. n-propylbenzene ; 11. 1-methyl-3-n-propylbenzene ; 12. n-butylbenzene ; 13. 1-methyl-2-n-propylbenzene ; 14. n-pentylbenzene ; 15. n-hexylbenzene ; 16. n-heptylbenzene ; 17. naphthalene ; 18. 2-methylnaphthalene ; 19. 1-methylnaphthalene.

Figure 2.

Dehydrogenation of n-paraffins : chromatograms of the product converted at 20% obtained in 1D-GC (A) and in GC×GC (B). The elution zone of naphthalene is circled with a dotted line and has been highlighted in the insert of Figure 2-B. Naphthalene is indicated with the symbol *. Experimental conditions : see Table 1 (2-B) and Table 2 (2-A).

Figure 3.

GC×GC analysis of a Fischer Tropsch product. Experimental conditions : Table 1. The repetitive pattern representing the distribution of isoparaffins, olefins, and alcohols in the elution zone of a normal paraffin is enhanced in the upper left part of the chromatogram.

Figure 4.

GC×GC chromatogram of a product of oligomerization. Experimental conditions : see Table 1. The elution zone of alkylbenzenes is framed with a dotted line.

Figure 1

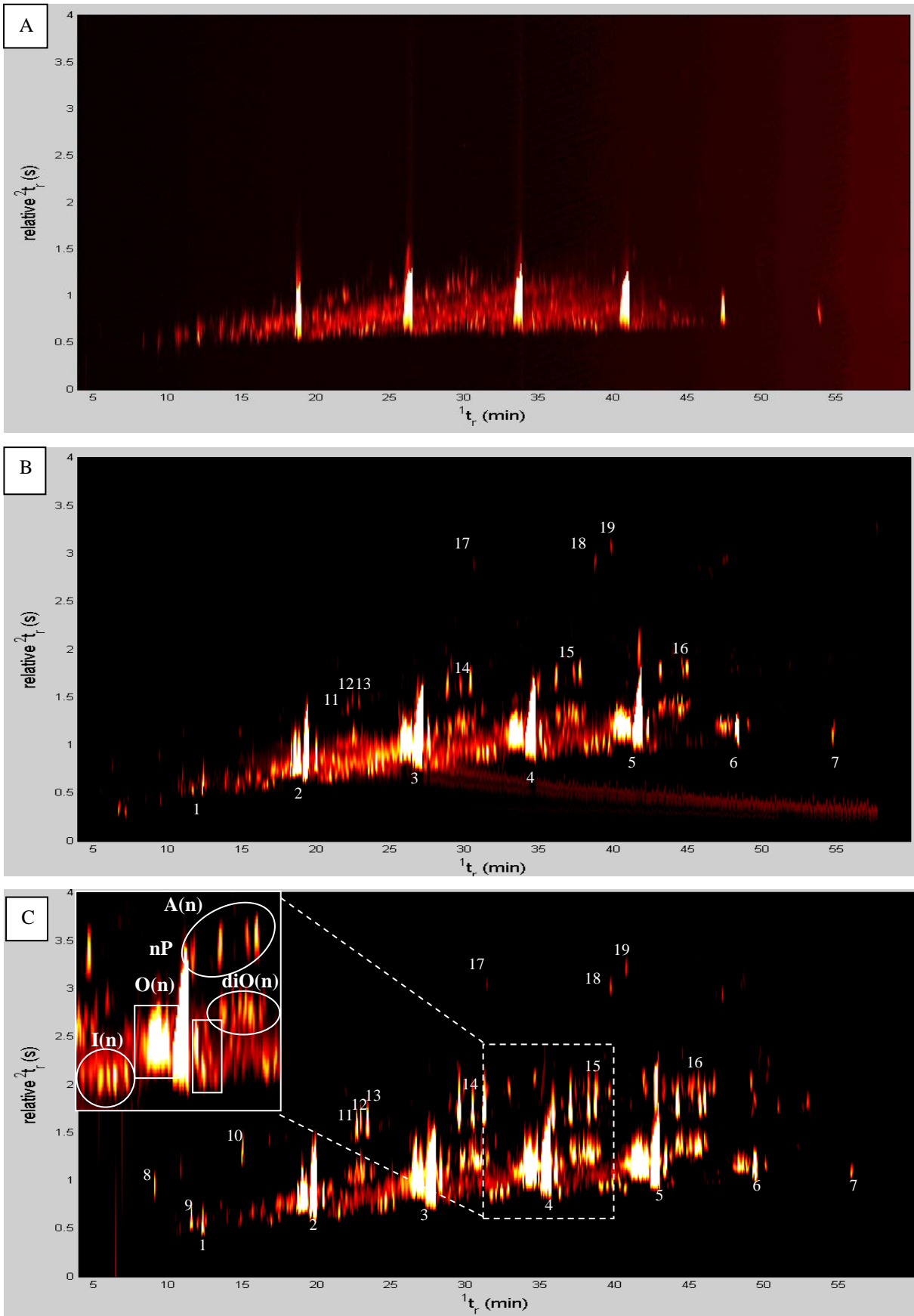


Figure 2

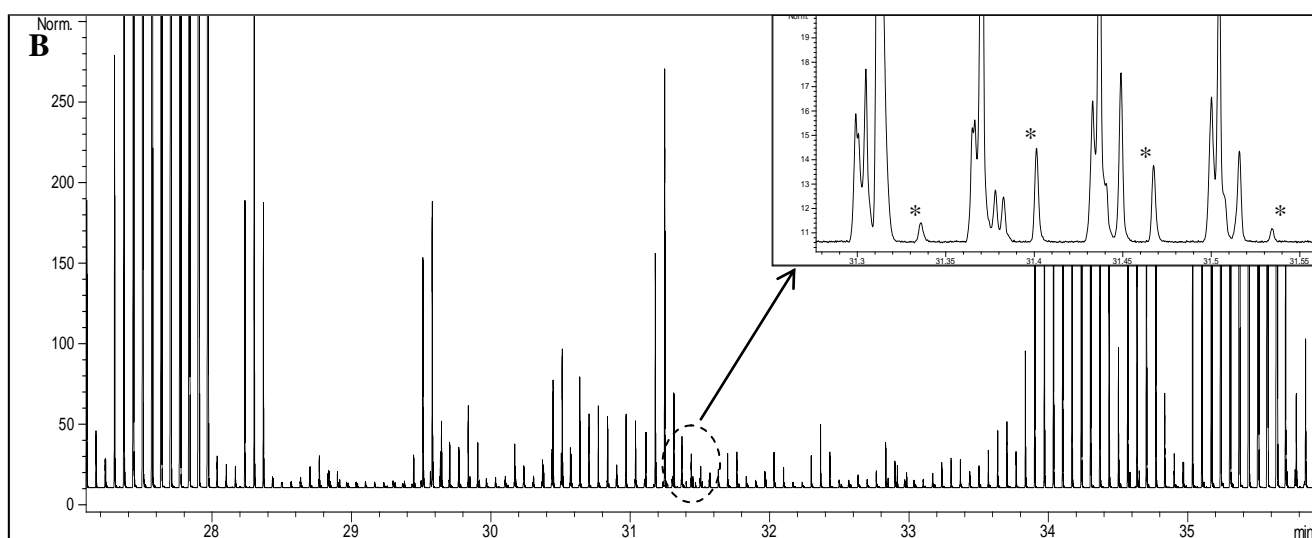
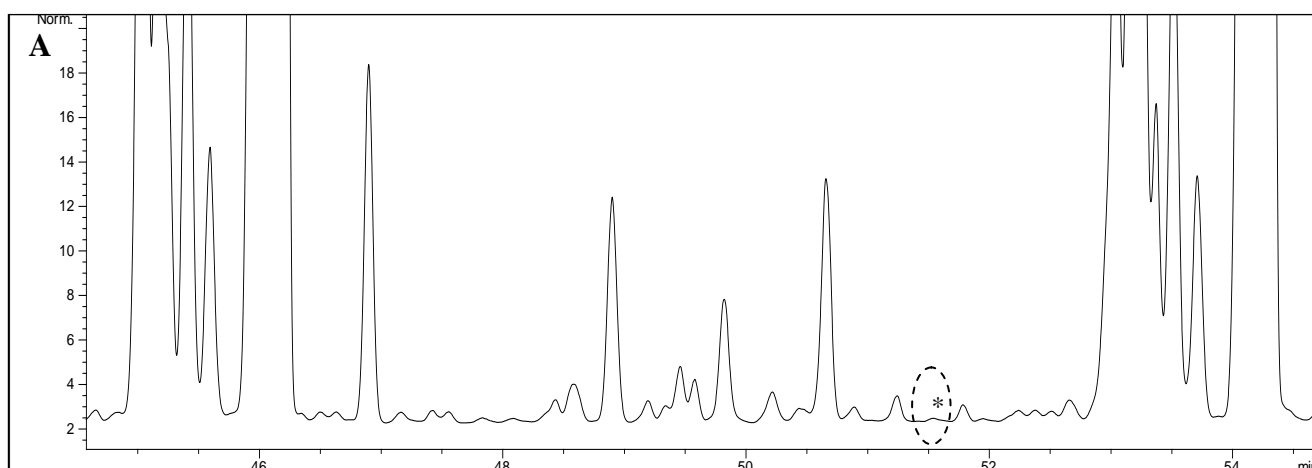


Figure 3

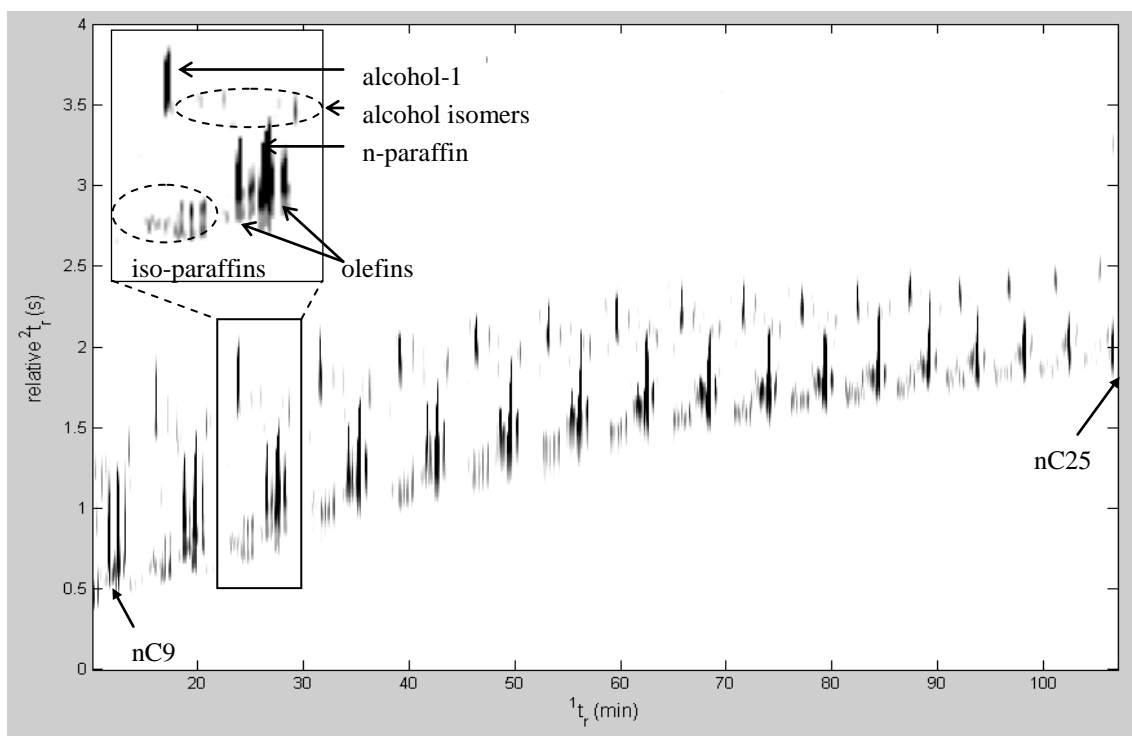


Figure 4

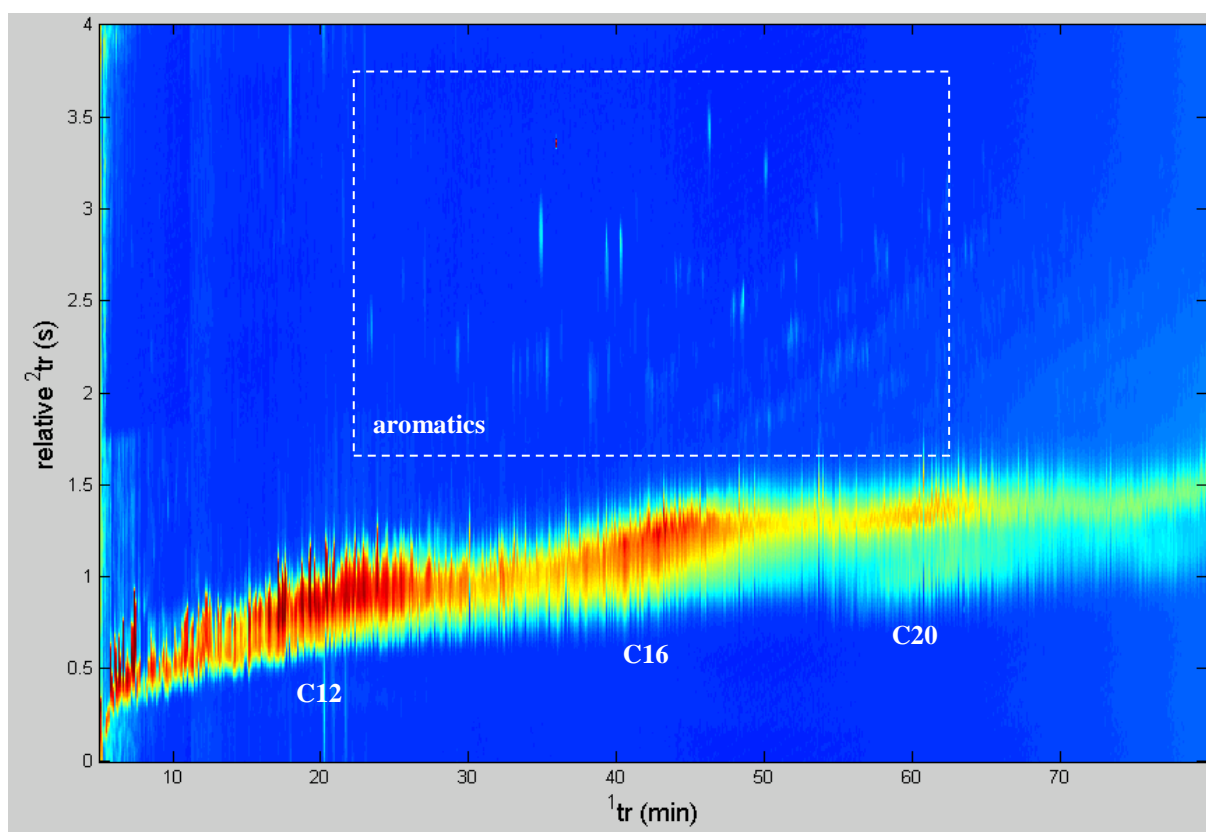


Table I. Experimental conditions used in GC×GC.

Conditions applied for each analysis	
First dimension column	PONA (20m×0.2mm ; 0.5µm)
Injection	
Temperature	280°C
Split	1 : 200
Injected volume	0.5µl
Detection	
Temperature	300°C
Gases	Air : 400 ml/min ; Hydrogen : 35 ml/min ; Helium : 25 ml/min
Acquisition rate	100 Hz
Modulation period	4 s

Additional conditions	
PIONA test mixture	
Second dimension column	BPX50 (0.1mm i.d. ; 0.1µm) or BPX70 (0.1mm i.d. ; 0.2µm) or CPWax (0.1mm i.d. ; 0.1µm)
Length 2 nd column (cm)	110
Pressure (kPa)	2.5
Temperature	T=50°C+2°C/min→150°C or T=50°C+5°C/min→150°C
Dehydrogenation of n-paraffins	
Second dimension column	BPX50 (1.1m×0.1mm i.d. ; 0.1µm)
Temperature	T=50°C+2°C/min→170°C
Pressure (kPa)	2.5
Fischer Tropsch	
Second dimension column	BPX50 (1.1m×0.1mm i.d. ; 0.1µm)
Temperature	T=50°C+2°C/min→280°C
Pressure (kPa)	2.5
Oligomerization	
Second dimension column	CPWax (1.1m×0.1mm i.d. ; 0.1µm)
Temperature	T=50°C+2°C/min→250°C
Pressure (kPa)	2.5

Table II. Conditions used in 1D-GC for the PIONA test mixture (a) and petrochemicals analyses :
Dehydrogenation of n-paraffins (b), Fischer Tropsch (c) and Oligomerization (d).

Column	PONA (50m×0.2mm ; 0.5µm)	
Oven temperature	40°C+2°C/min →280°C +60min ^{a,b} 35°C+10min+1.1°C/min →114°C +1.7°C/min→300°C ^{c, d}	
Pressure	2 kPa	
Injection	Temperature	280°C ^{a, b, d} 300°C ^c
	Split flow	200 ml/min
	Injected volume	0.5µl
Detection	Temperature	300°C ^{a, b, d} 350°C ^c
	Acquisition rate	5Hz